A Digital Rescue for a Graduation Ritual

Robert E. McGrath
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Abstract

High quality digital reproductions of cultural artifacts are potentially valuable documentation for rare artifacts, supplementing other documentation. Three dimensional reproductions can also be used to create vivid digital experiences for telling stories about cultural heritage. Scholars and story tellers are still learning how best to use these technologies.

This paper reviews a large-scale Augmented Reality (AR) installation created in 2013. The installation presented a high-resolution laser scanned representation of a larger than life sculpture at full size and in its original outdoor setting. More importantly, the AR application played an integral part in an important community celebration.

The project was well received, and was successful not because it achieved millions of downloads, but because it *had a very good reason to exist, and everyone understood and appreciated exactly why it was there.*

Introduction

It is now relatively easy to create immersive experiences to study and portray cultural history. However, there remain many questions about how these technologies can and should be used to best effect.

High quality digital reproductions are potentially valuable documentation for rare artifacts, supplementing two dimensional images, drawings, physical models, and written descriptions [Wachowiak and Karas 2009]; [Marshall et al. 2018]. Once created, such a three-dimensional dataset is quite versatile, with many potential uses. The scanned data may be used for detailed study or to fabricate reproductions [Neumüller et al. 2014]. The digital dataset can also create derived datasets, including digital assets for virtual worlds, such as video games, computer-generated cinema, or Virtual and Augmented Reality.

Augmented Reality (AR) has many potential uses in cultural preservation, museumology, and similar domains [Craig 2013]. Telling stories about culture can be augmented with immersive experiences which may convey a vivid presentation of another time or place [Seibert-Johnston 2014]. This augmented digital world is an artistic recreation which may include digital reproductions of artifacts, landscapes, or built spaces.

This paper presents a case study of a large-scale AR installation created in 2013. The AR application presented a high-resolution laser scan of a larger than life bronze

sculpture. The digital reproduction was displayed at full size and outdoors, and, significantly, played an integral part in an important community celebration.

I believe that this project offers lessons for the design of AR experiences for cultural heritage. The following sections sketch the application, the results and reception, and a brief discussion of lessons that may be learned.

A Case Study: A Campus Icon, Digitized

This case is a specific episode in the history of a monument with a local cultural significance. The continuing history of the artifact was enhanced by a culturally appropriate digital intervention.

The Original Object and Its Meanings

In common with many universities, the University of Illinois Urbana Champaign campus features public art accumulated over its 150 year history [Scheinman 1995]. Arguably the most famous of them is the **Alma Mater** (1929), created by university alumnus Lorado Taft ([Scheinman 1995], pp. 14-15). The bronze sculpture is a group of three larger than life sized figures, representing “Alma Mater” and two allegorical figures reflecting to the University motto, “Learning and Labor” [Beuttler 2018]. (See Figure 1.)

Installed in 1929, and moved to its current prominent site in 1962, Alma’s meaning to the University community has evolved over her life. The original conception of this piece was an eclectic soup of nineteenth and twentieth century allegories, calling forth Western and Christian civilization, with a nod to broad-shouldered proletarian progress, plus the nostalgic blessings of midwestern family life (see [Scheinman 2018]; [Scheinman 1995]).

The figure of “Learning” is modelled after the Greek *Lemnia Athena* (circa 300 BCE), while the brawny figure of “Labor” is inspired by nineteenth century works by Belgian Constantin Meunier. The texts include a Biblical verse (*"Her children arise up and call her Blessed",* Proverbs 31:28). Alma herself represents the blessings of family and home.

Specific to the University, the figure of “Learning” was certainly intended to represent the importance of traditions of classical European culture, while “Labor” refers to the University’s mission to improve the masses and develop practical technology. Alma’s maternal embrace acknowledges the nurturing role of the University for its young scholars.

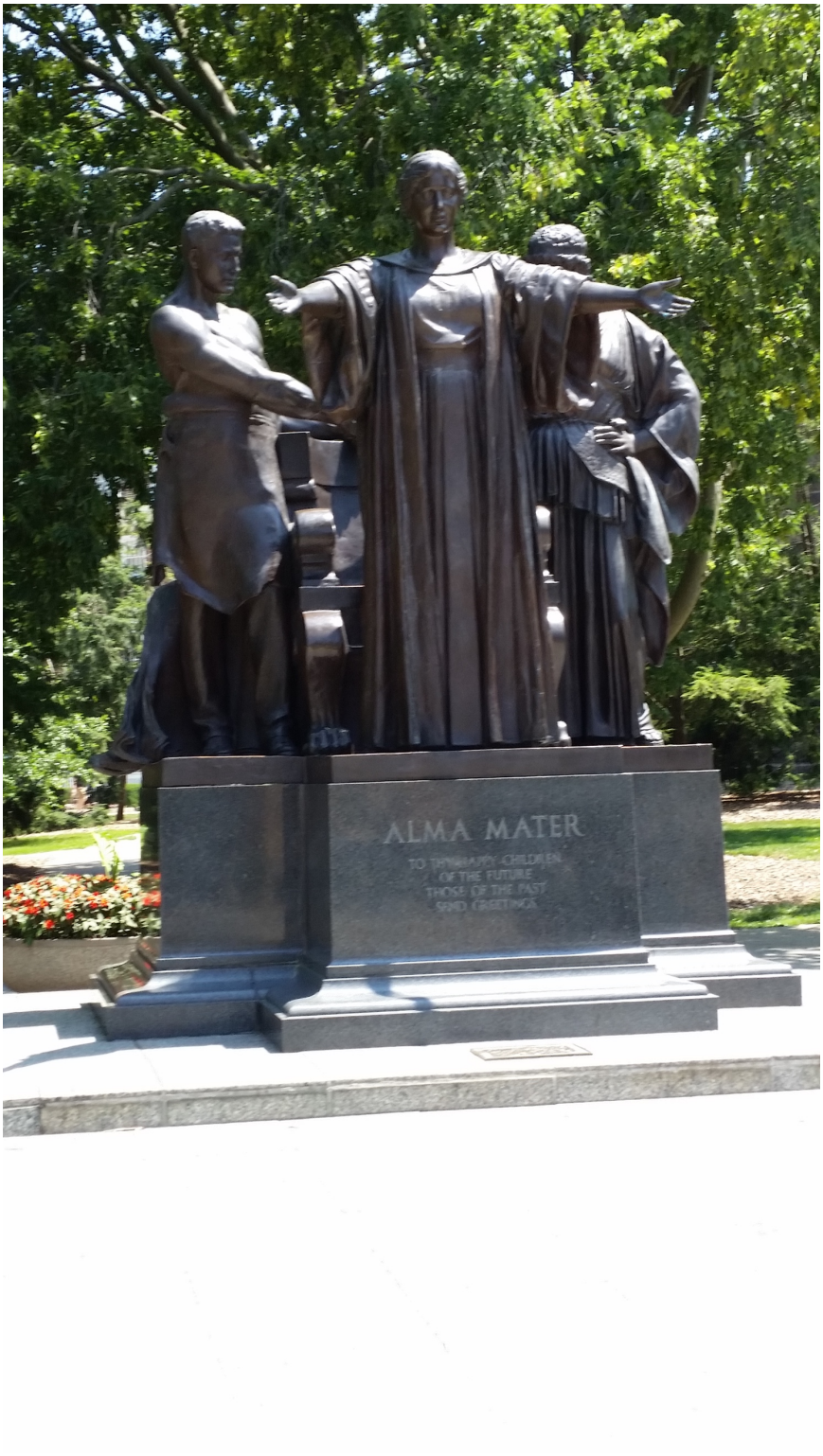

Figure 1. ***Alma Mater*** *by Lorado Taft (1929) in July 2018 (after restoration). (Credit: Robert E. McGrath, 2018)*

The poses of the figures carry further symbolism. The allegorical figures “Learning” and “Labor” are amicably clasping hands, reflecting the University motto and its aspiration to unite theoretical and practical knowledge, Western Civilization unfolding on the industrial prairie. Alma herself is supposed to represent the cordiality of a Midwest mother, who is a “lady with wide-spread arms and smiling face” [Scheinman 2018]. Finally, where Alma seems to have just risen from her ancient Greek *klismos* throne, students are invited to sit and take their own place amid this amicable group of giants [Scheinman 2018].

Alma’s original meaning has largely faded over her eight decades. It is likely that few of her twenty first century children know the original allegorical associations of this work, or would necessarily identify with the sentiments implied.

Nevertheless, she persists.

In the twenty first century, the monument has accrued new cultural meaning as a positive (and noticeably feminine) symbol of the contemporary University community. Alma’s image appears on official materials as part of the University brand. Alma herself has dressed up for occasions (such as a film festival or building dedication), and she has taken tea with the Chancellor [University of Illinois at Urbana-Champaign 2012]. “Alma” sometimes addresses her children via Facebook or Twitter, and she must have appeared in many unauthorized versions in images and on the Internet.

In recent decades, the Alma Mater statue has become a popular backdrop for personal photographs. The highlight of her year surely comes at spring commencement, when hundreds of new graduates pose for photos under the proud arms of Alma. The ritual has grown to attract a large, festive crowd of graduates, families, and well-wishers who wait in long lines for her blessing.

This joyous communal tradition emerged spontaneously as part of the students’ own celebrations, largely without instigation, direction, or permission from the University or anyone else. In recent years, the University administration has taken note of the event, and now assists the affair with staff, publicity, and other support.

Alma’s Renovation Crisis And A Digital Response

By 2010, the eighty-eight-year-old bronze had deteriorated to the degree that the structure was dangerous. In addition to natural aging, Alma has endured relocation in 1962 and a misguided intervention in 1981. In 2012 the bronze statue was dismantled and removed for careful cleaning and repairs. In the course of the restoration work the statue was laser scanned yielding a complete, sub-millimeter resolution digital model of the work in its restored glory [Dajnowski et al. 2015].

The restoration required more time than originally hoped, with the result that Alma could not be returned to campus by graduation time in May of 2013. Given her important, if

unofficial, role in the annual commencement events, her absence was bound to be a disappointment for many graduates and visitors.

What could be done to salvage the communal rite for the unlucky class of ‘13?

An “Augmented Alma” App

Responding to the crisis, a team was rapidly assembled with the goal to rapidly create an AR experience to deploy during commencement days in early May. The idea was to project the scanned 3D model of Alma onto her empty pedestal in a way such that graduates could have their pictures taken, just as in earlier years. This was an ambitious project for the time, attempting to project Alma full size, larger than life, outdoors, for hundreds of people.

The “Augmented Alma” app was designed as a *magic lens* ([Craig 2013]) application for handheld devices which projects a three-dimensional virtual scene registered onto a target in the physical world [Dajnowski et al. 2015]. The laser scanned dataset from the conservation work was converted into a highly detailed digital model with a photo realistic skin portraying the future restored appearance, bronze rather than the heretofore familiar corroded green patina. The digital statue was placed in a scene scaled and registered so the digital model would be visible on top of the target at full size.

The AR target used was a large poster of Alma (more than two-meter-high by 1 meter wide), placed upon the empty pedestal. Viewed through the app, the large 3D image projected around and visually replaced the 2D poster, showing the virtual statue to scale, just where the missing statue would be.

The AR software was installed on a dedicated tablet computer mounted on a modified camera tripod, strategically placed at the site pointing at the pedestal where graduates would stand. The scene on the tablet screen revealed the virtual alma in her rightful place atop her pedestal. Equally important, when graduates posed in front of (virtual) Alma, the screen capture feature of the tablet recorded the traditional souvenir photograph of the occasion, which was delivered electronically. (See Figure 2)

During the days of graduation ceremonies (May 9-11, 2013), hundreds of students were able to pose in the traditional spot, with the replacement Alma visible via the AR application [Dajnowski et al. 2015]; [University of Illinois 2013]. A copy of the app was operated by an ‘official photographer’ who explained the effect, captured the images, and delivered to the graduates. In this way, the temporary absence of the iconic statue was both recognized and bridged, and the class of 2013 was able to celebrate in a special way.

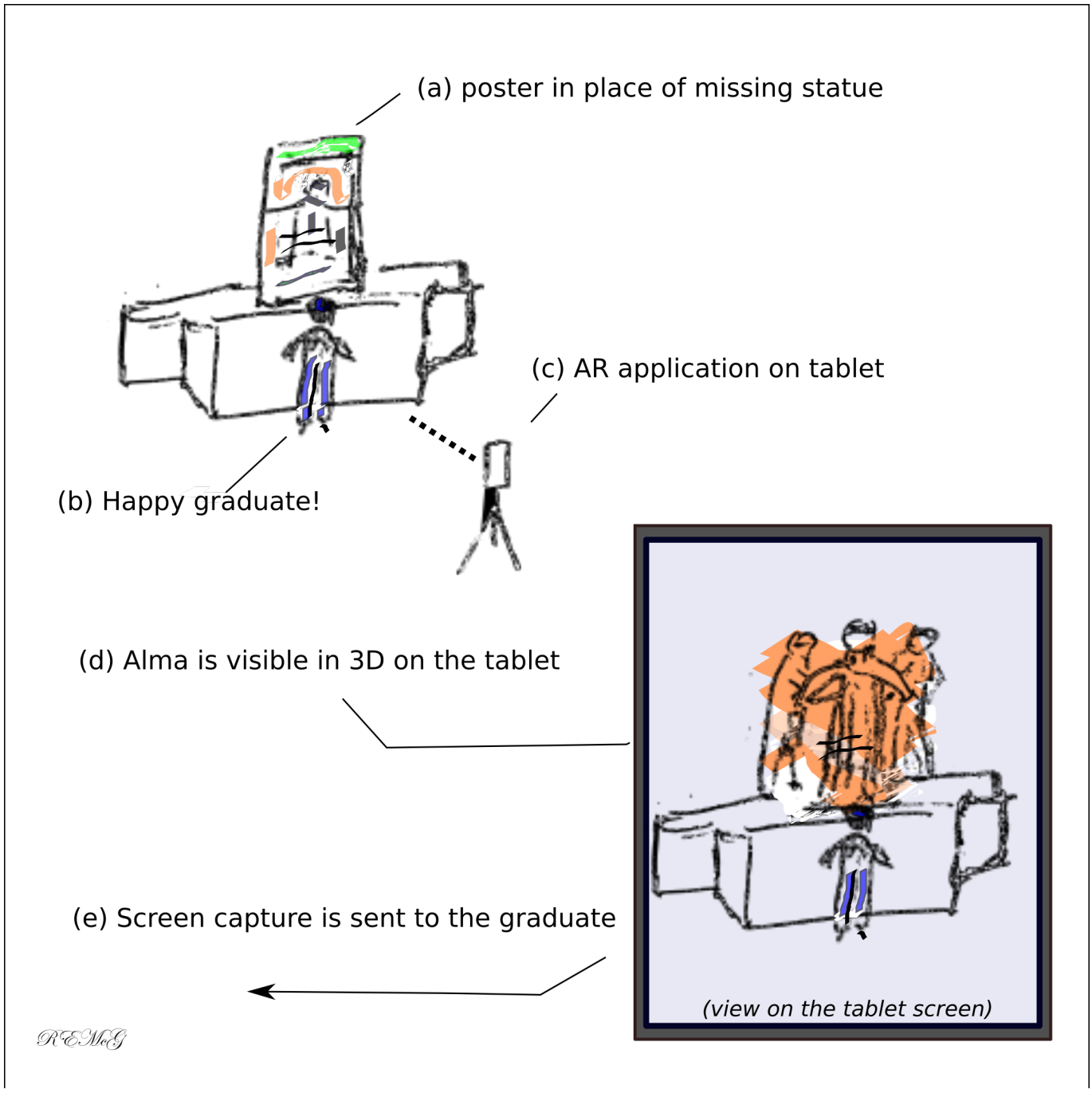

Figure 2. Sketch of the operation of the Augmented Alma app. (a) the empty pedestal with a large poster as the AR target, (b) graduates pose in the traditional location, (c) tablet mounted on camera tripod with AR app pointed at the scene, and (d) the AR view: the graduate is posing in front of the virtual statue and (e) a screen capture is sent to the graduate. (Credit: Robert E. McGrath, 2018)

Discussion and Lessons Learned

The Augmented Alma was generally received as a success from several perspectives [Steinfeldt 2018]; [Craig 2018].

The app was technically successful, demonstrating an effective use of high-resolution scanned data in a public setting. The AR experience was robust and compelling, presenting the larger than life statue full size, *in situ*, in natural daylight. AR technology has improved considerably in recent years, so it is important to remember that these results were not a foregone conclusion at the time.

The project was culturally important to the University community as well. The AR experience contributed to an important cultural event, helping to salvage an important rite of passage. First, the AR application with its stunning scanned graphics made a memorable souvenir for celebrating graduates, filling in for the missing icon. Second, creating the experience demonstrated the University's commitment to the occasion, and marked the occasion in a uniquely fashion. And third, as a practical application of advanced technology, it was perhaps an apt embodiment of the University mission, characterized by its motto, "Learning and Labor". This was a fitting symbolic continuation of Alma's legacy into the twenty first century.

Usage and Impact

Hundreds of graduates received souvenir images in front of the virtual Alma. Comments at the time indicate that this opportunity made people happy [Steinfeldt 2018].

Due to the compressed development process, the Augmented Alma app was not widely available for download at deployment. In fact, essentially all the usage was via the installation operated by the "official photographer" as described above. In both the commercial and academic world, broad dissemination is often a key metric of success. However, in this case, the success of the installation arguably was due to the *limited* dissemination of the app. In order to replace the customs of previous years, it was critical that Alma was present *only* to the graduates, at *that* site and at *that* time.

In an age used to digital media unconstrained by time and space, the deliberately limited design of the app was a bit of a shock for some. This limited availability violated the expectation of the digitally native graduates, and certainly vexed some of the observing media. Some media crews hoped to capture the virtual statue on her pedestal with their cameras—which was not possible. It was an interesting situation, because the people could see her, but the TV cameras could not.

The use of a dedicated tablet operated by an 'official photographer' contributed to the experience in another way, it turned the static installation into a *performance*, a public and social event, rather than a rather than a broadcast viewed on private screens. Acting out this little story may have unconsciously evoked nostalgia for an earlier, pre-selfie, age—the past age that the massive bronze trio represents. It also invited

everyone to focus on the “magic”, and to watch their peers pose, and generally drew attention away from personal screens.

Evaluation of the Technical Design and Implementation

The Augmented Alma app was created by a rapidly convened of a multidisciplinary team with a limited budget and very limited time to work [Steinfeldt 2018]; [Craig 2018]. The bulk of the cost and effort probably was the 3D scanning, which required specialized equipment and expertise. The rest of the work, from processing the raw data to create the 3D model, creating and testing the app, and creating the target poster, was completed in a few dozen hours, using tools and techniques already in hand. In essence, the project was possible because it successfully mustered deep knowledge already developed at the University.

The external deadline imposed by graduation day enforced a very compressed development timeline, with limited opportunity to coordinate, experiment, acquire new technology, or even test the application. The time limit required that the application work the first time. Consequently, the design was kept simple and focused on the primary goal, and the implementation was built with what was already at hand.

Testing the app was very challenging. The AR effect depends on the performance of the computer vision with a specific device in a specific setting. Small scale and bench testing could not predict how well or whether the app would even work *in situ*. Testing at the site required installation of the large poster, on the platform, in daylight, which involved a work crew, and could not be iterated if problems were found. A large crew running the rehearsal test in public also made complete surprise difficult.

Finally, there was insufficient time to complete the workflow to distribute the mobile app through normal channels. Submission to the Apple and Android stores is a complicated process, with many legal and administrative tasks as well as technical requirements. At the end of submission, a new app must wait for review and approval by the companies. This whole process generally takes 30-60 days, which was longer than the entire Augmented Alma project from start to deployment. As a result, there was no realistic option to make the app available for public downloads, let alone to promote it.

This constraint on publishing mobile apps led to the local and private deployment described above, which gave the installation its most prominent design characteristics, and arguably contributed significantly to the successful communal experience.

Initial worries about the technical challenges proved largely unfounded, the results were robust and compelling. The AR application worked well through the day even as the natural lighting and background shadows changed, and, indeed, even during a rain shower. The illusion ultimately failed near sundown, when the shadows of buildings shrouded the target [Steinfeldt 2018]. The AR projection worked correctly at distances from one meter to approximately ten meters from the target, and out to approximately 180 degrees on either side. The digital graphics adapted from the laser scan were

stunningly detailed, revealing fine features of the sculpture that had long been obscured by surface corrosion.

Repurposing and Multipurposing 3D Scanned Data

High resolution three-dimensional scanning of artworks and other cultural objects is becoming more common ([Wachowiak and Karas 2009]), though the resulting datasets are not necessarily widely or well used. The Augmented Alma project illustrates a successful case using for this kind of data as part a public ritual, in fact, and outdoor participatory performance.

The high-quality scanned dataset in and of itself is important documentation of the state of the Alma Mater art work at the time of the restoration. No amount of two-dimensional imagery and textual description can match the sub millimeter precision of a three-dimensional digital record of the statue. Ideally, the digital files will be preserved for research and education as part of the archival record for this piece. (However, the best approaches to long term archival preservation of such a complex digital object is still an open problem [Bettivia 2016].)

The Augmented Alma project demonstrated how such digital archival materials have additional value because they are amenable to multiple uses, reuse, and remixing. In this case, the scanned data was used to generate a dataset in a format compatible with ubiquitous software used for video game design. In this form, the dataset can be used for many purposes.

For instance, the same digital data used in the Augmented Alma application could potentially be used in virtual game worlds, as digital cinema effects, or for three-dimensional printing. (It should be noted that there are many open questions about how best to make the data available for research and scholarship, while still preserving potential commercial and branding rights of the University.)

It is extremely important to note, though, that the data in the Augmented Alma application may have *looked* fantastic, but it was not actually a faithful reproduction, and should *not* be used for scholarly investigation or future conservation. That is, the *data in the app* was *derived* from the high precision scan data, and therefore definitely not a precise record of the statue. Future studies should use the original, carefully curated, full resolution scanned datasets. (It is an open question how to prevent inappropriate use of derived data instead of the valid calibrated dataset, or how to deal with accidental or deliberate misuse of such derived data.)

Implications for Other Projects

First of all, as discussed above, the success of Augmented Alma was *not* due to wide distribution or massive numbers of users. Rather, it fit the specific cultural event, and was used by the specific group of people who were targets. Augmented Alma was

intended to stand in for the missing bronze icon on the specific occasion, in order to help graduates celebrate a tradition in the customary fashion. No more, and no less.

Second, the full-scale AR illusion fit precisely into the existing ritual, supporting the traditional festive gathering in a completely natural way. The digital substitute both acknowledged the missing statue and offered a unique souvenir as a (one time) replacement.

Third, the effect itself was an impressive technological wonder, worthy of both the institution and the occasion. It is important to note that at the time AR was not yet as common as today, and so this was the first experience of AR for many of the students and guests. (In 2013, Pokémon Go [wikipedia 2018] was three years in the future.) Even today, very few AR experiences have the large scale and detailed graphics of the Augmented Alma in 2013. What better way to celebrate the special occasion at a premier technical school than a ground-breaking technological spectacle?

Fitting the Context

However significant the technical achievement, the greater success was the contribution to an important rite of passage. The app was designed and deployed as part of a social context, and the social context was primary.

First, as already discussed, the installation was temporally and spatially specific. AR technology allows digital models to be projected anywhere, and placed in any virtual scene, at any scale and at any time. But that doesn't mean that every digital object should appear everywhere or anywhere.

One important feature of AR is that it can be tied to a very specific location and occasion. This was critical for the Augmented Alma deployment in which Alma was visible *only via the application*, and *only on her pedestal*, exactly where the physical statue would have been, and *only to those who gathered together* for this occasion.

In short, using the ability to limit the digital experience was crucial to making it fit the occasion, and for people to *understand* and *value* the application. Limiting the application to the cultural context helped communicate that the digital representation was not imagined to be "just as good as" the original (which it could never be), or merely as a technical spectacle to be marveled at. She was there as a representative of the missing statue, in respect for the continuing traditions of the institution, and to honor the community of graduating students.

The Augmented Alma had a very good reason to exist, and everyone understood and appreciated exactly why it was there.

Technical Wonder

Part of the success of the Augmented Alma app was its technical spectacle. While there were several other “replacements” for Alma that week (such as plaster sculptures, images, and even live actors), the AR app stood out for its novelty, scale, and visual quality. The many technically savvy students and guests involved would have understood the mastery of the then novel application, and that it was a worthy representation of both the institution and the occasion.

Many aspects of the presentation contributed to a sense of technological magic. The large-scale, high-resolution graphics derived from the laser scans were truly impressive and the AR effect worked extremely well. In fact, the developers themselves were surprised by the quality of the experience.

Even some of the technical errors in the application may have enhanced the sense of wonder, at least subconsciously. In the initial deployment during graduation, the digital model was incorrectly rendered and misplaced on the pedestal. Alma was floating slightly in the air and too far forward. The most noticeable error, though, was the color mapping ([Slick 2018]), which was incorrectly applied to the 3D model, which had the effect of making the statue appear a strange bright orange, not representative of either the original or the restored statue—or any possible real-life statue. (The color map was later corrected.)

These mistakes could even be taken as symbolic, as the digital Alma (accidently) appeared to float weightlessly and to glow unearthly (Illini) orange, suggesting a one-time magical visit.

The specific devices and software used to create Augmented Alma are now obsolete, and for that reason they have been omitted in this paper. Recreating the Augmented Alma with newer technology would require similar effort, if anything, development would be easier than in 2013, and the performance of the app would be superior. However, the essential challenges would be very much the same.

Since AR is becoming more familiar, especially on University campuses, which might diminish the “magic” of the experience. Nevertheless, the key to success would still be fitting the context, not technical spectacle.

Conclusion

This Augmented Alma project demonstrated one way to use a high-resolution reproduction of a cultural artifact: in an AR experience embedded in a community celebration. The Augmented Alma app also demonstrated that even five years ago, AR technology was capable of operating outdoors in natural light at large scale. Alma should inspire AR designers to think big.

Overall, the digital augmentation was successful because fit the occasion so well. Augmented Alma was site and time specific, matched closely to the pre-existing cultural

practice: the application was successful on graduation day because *it had a very good reason to exist, and everyone understood and appreciated exactly why it was there*

Therefore, Augmented Alma would have been a success *even if no one ever downloaded it*. This evaluation flies in the face of commonly used metrics of success for mass distribution and consumption of digital media.

Perhaps the greatest contribution of the Augmented Alma project was to extend and enrich the Alma Mater art work's continuing significance to the University community. The beloved symbol was temporarily replaced by a digital spectacle that demonstrated the technical prowess and multidisciplinary collaboration of the University, and kept a generational commitment to the joyous communal celebration at graduation time. It was a fitting embodiment of the University motto "Learning and Labor", which the Alma group has symbolized in bronze for nearly a century.

And finally, the most important result was that "it made people happy" [Steinfeldt 2018].

Disclosure: The author participated in the design and implementation of the Augmented Alma app. The views expressed in the paper are the author's own.

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